**REMARKS**

Applicants have amended claims 1, 2, 7, 20, 22, 23, and 27. No new matter has been entered by way of these amendments. Applicants note with appreciation the Office's indication that claims 7-13, 15-17, 19-20 and 27-31 would be allowable if rewritten in independent form and that claims 33-35, 37-39 and 41 are allowed. Applicants respectfully request clarification from the Office with respect to the status of claims 27 and 41. With respect to claim 27, the Office has indicated this claim would be allowable if rewritten independent form, but has also indicated this claim is rejected. With respect to claim 41, the Office has indicated this claim is allowable, but has also indicated that this claim is rejected. In view of these above amendments and the following remarks, Applicants hereby request further examination and reconsideration of the application, and allowance of claims 1-35, 37-39, and 41-42.

The Office rejected claims 1-6, 14, 18, 22-27, and 42 under 35 U.S.C. 103(a) as being unpatentable over the article "Multi-spectral color reproduction research at the Munsell Color Science Laboratory" to Berns et al. ("Berns") in view of the article "Spectrophotometric image analysis of fine art paintings" to Maitre et al ("Maitre"), claims 21, 32, and 41 under 35 U.S.C. 103(a) as being unpatentable over Berns in view of US Patent No. 5,949,914 to Yuen ("Yuen"). The Office asserts that Berns discloses: capturing high spectral resolution data of at least a first portion of a first scene using a first plurality of channels (page 16, section 3, note that the first plurality of channels could be 61 channels ) ;determining a first set of channels (minimum number of channels) from a second plurality of channels which can reconstruct spectral of the first portion of first scene (page 16, section 3, page 18) to satisfy a first error criterion when compared with the captured high spectral resolution data (Fig. 1, page 15-17, section 3, note that the error criterion is the least-square, see page 17, formula 3); and capturing pixel data of at least a second portion of at least first scene using the first set of channels (page 16-18, section 3, note that capturing or reconstructing at least a portion of pixel data is inherent when the portion of the image is reconstructed). The Office acknowledges that Berns does not explicitly mention the use of the error criterion is used for choosing channels, but asserts that Maitre, in an analogous environment, discloses using a error criterion (equation 10 or 11) to choose optimal channels (filters) (page 52-53). The Office also acknowledges that Berns does not explicitly mention that the number of first and second channels or subsystems are identical, but asserts that Yuen discloses using multiple identical channels or sub-imaging systems (Fig. 9a).

Berns, Maitre, and Yuen, alone or in combination, also do not disclose or suggest, "wherein the first set of channels from the second plurality of channels comprises a smallest number of the plurality of channels which can be used to reconstruct spectra of the first portion of the first scene to satisfy a first error criterion when compared with the captured high spectral resolution data" as recited in claim 1 or "wherein the first set of channels from the plurality of channels comprises a smallest number of channels which can be used to reconstruct spectra of the first portion of the scene to satisfy a first error criterion when compared with the captured high spectral resolution data" as recited in claim 22.

The Office's attention is respectfully directed to the section entitled, "Introduction" on page 50 in Maitre which states, "It is well known that with 3 well-chosen filters, it is possible to obtain a good reconstruction of the color tristimulus values of the reference human observer as defined in colorimetry. Our aim is to reconstruct as precisely as possible the spectral reflectance curve using more than three filters." (Emphasis added). Accordingly, Maitre clearly is not teaching or suggesting determining the smallest number of filters which would obtain a good reconstruction, but instead is teaching the selection of filters to reconstruct as precisely as possible. As discussed in paragraph 3 in the Background of the above-identified patent application one of the problems with prior spectral imaging systems is with data overload problems. Thus, even if Berns was considered in view of Maitre as proposed by the Office, they would still not teach or suggest the claimed invention.

Additionally, there is no motivation to combine Berns with Maitre because as described in the third paragraphs on page 16 in Berns the desired number of filters has already predetermined so there is no reason for one of ordinary skill in the art to consider modifying that number of filters. More specifically, as described in fourth full paragraph on page 16 through the first paragraph on page 17, Berns discloses determining a spectral reconstruction ($f = \Phi\alpha + \mu_f$) for a sample (f) when a monochrome digital camera with seven different filters of differing spectral sensitivities is used to obtain the image data of the sample using seven channels (corresponding to each the filters).

As described in the Summary in paragraph 6 in the above-identified patent application, "The present invention improves data overload problems previously associated with general spectral imaging as well as alleviating the tradeoffs between accuracy and generality associated with previous specialized spectral imaging. The present invention has recognized that for any particular object in a scene or for any scene in total there is one or

more sets of channels which contain an optimally minimum number of channels and an associated transform which can be used for accurate spectral reconstruction of that object and scene. As a result, the present invention strives to approximate an optimal set of channels and to derive an optimal transform for every scene or portion of scene encountered. The extent to which optimums are realized is limited by the specifics of any particular system implementation. The number of channels in an optimal set could be as few as two or three or many more, depending upon the specific characteristics of an object or scene and the nature of the mathematical constructs of the transforms chosen for an implementation." Accordingly, the present invention does not just identify the set with the smallest number of channels, but determines the set with the smallest number of channels which also satisfies the chosen error tolerance.

Thus, in view of the foregoing remarks, the Office is respectfully requested to reconsider and withdraw the rejection of claims 1 and 22. Since claims 2-6, 14, 18, and 21 depend from and contain the limitations of claim 1 and claims 23-26, 32, and 42 depend from and contain the limitations of claim 22, they are distinguishable over the cited references and are patentable in the same manner as claims 1 and 22. As mentioned above, the Office has indicated that claims 27 and 41 are already allowable.

Additionally, Berns, Maitre, and Yuen, alone or in combination, do not disclose or suggest, "performing an iterative optimization to determine a first set of channels from a second plurality of channels which can reconstruct spectra of the first portion of the first scene to satisfy a first error criterion when compared with the captured high spectral resolution data" as recited in claim 2, or "a spectral processing system that performs an iterative optimization to determine a first set of channels from a second plurality of channels which can reconstruct spectra of the first portion of the first scene to satisfy a first error criterion when compared with the captured high spectral resolution data, wherein the imaging system captures pixel data of at least a second portion of at least the first scene using the first set of channels" as recited in claim 23.

The Office's attention is respectfully directed to Berns at the fourth full paragraph on page 16 through the first paragraph on page 17, where Berns discloses determining a spectral reconstruction ($f = \Phi\alpha + \mu_f$) for a sample (f) when a monochrome digital camera with seven different filters of differing spectral sensitivities is used to obtain the image data of the sample using seven channels (corresponding to each the filters). Berns

states that "[f]or the multi-spectral camera, however, the spectral reconstruction needs to be based on the camera signals, s. This can be achieved by computing a least-square (5x7) matrix, M, to transform the camera signals into estimates of the scalar coefficients $\alpha$." Referring to the top of page 17 in Berns, this results in changing the original spectral reconstruction ($f = \Phi\alpha + \mu_f$) shown above for the monochrome digital camera to a modified spectral reconstruction ($f = \Phi$ M s) suitable for reconstructing spectral data for a sample (f) imaged using a multi-spectral camera. However, computing the least-square matrix M in Berns is not the performance of an iterative optimization to determine which of the seven filters out of a plurality of filters will satisfy a first error criterion. Similarly, neither Yuen nor Maitre disclose or suggest performing an iterative optimization to determine a first set of channels from a second plurality of channels which can reconstruct spectra of the first portion of the first scene to satisfy a first error criterion as claimed.

The present invention recognizes that for each object in a scene there is an optimally minimal number of channels with an associated transform which can be used for accurate spectral reconstruction of a scene. As discussed in paragraph 23 on page 7, lines 19-25 of the above-identified patent application this determination is accomplished by, "[performing] an iterative optimization determining a matrix which when applied to the captured pixel data from a set of channels, the closest reconstruction of the highly accurate spectra may be realized. The set with the smallest number of channels which can approximate the highly accurate spectra across all captured pixels within an average spectral RMS difference that is less than the error tolerance e is chosen as the optimal set." Thus, in view of the foregoing remarks, the Office is respectfully requested to reconsider and withdraw the rejection of claims 2 and 23.

The Office has objected to claims 7-13, 15-17, 19-20, 27-31 as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant has rewritten claims 7, 20, and 27 in independent form to substantially include all of the limitations of the base claim and any intervening claim. In view of the foregoing amendments and remarks, no further amendment of these claims is believed to be necessary and the Office is respectfully requested to reconsider and withdraw the objection to these claims.

In view of all of the foregoing, applicant submits that this case is in condition for allowance and such allowance is earnestly solicited.

Respectfully submitted,

Date: May 12, 2004

Gunnar G. Leinberg
Registration No. 35,584

NIXON PEABODY LLP
Clinton Square, P.O. Box 31051
Rochester, New York 14603
Telephone: (585) 263-1014
Facsimile: (585) 263-1600

CERTIFICATE OF MAILING OR TRANSMISSION [37 CFR 1.8(a)]

I hereby certify that this correspondence is being:

☒ deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450

☐ transmitted by facsimile on the date shown below to the United States Patent and Trademark Office at (703) ________________.

May 12, 2004
Date

Sherri A. Moscato
Signature

Sherri A. Moscato
Type or Print Name